



## Original Article

## Application of an Intranasal Drill on Transnasal Endoscopic Marsupialization of Postoperative Maxillary Mucoceles

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### Abstract

**Objective:** Postoperative maxillary mucoceles occur as a delayed complication of radical surgical intervention in the maxillary sinus. Conventionally, the recommended procedure for treating this entity has been the revised Caldwell-Luc operation. In this study, we present a less invasive treatment methodology which is as safe and effective.

**Materials and Methods:** Between January 1988 and December 2006, inclusively, 36 patients (47 sides) were enrolled in the study. Twenty-eight patients (38 sides) underwent the endoscopic marsupialization technique. Eight patients (9 sides) received a revised Caldwell-Luc operation, and this group was used as the control. Under nasoendoscopic guidance, an antrostoma was created through the inferior (29/38) or middle (9/38) meatus, and the opening was then enlarged to a diameter almost equal to that of the mucocele itself. A 15° intranasal drill was used where the medial wall of the maxillary sinus was bony.

**Results:** Only one patient complained of mild cheek pain after marsupialization surgery. The opening remained patent in 89.5% (34/38) of the mucoceles 1 year after the transnasal endoscopic operation. Twenty of the 38 maxillary sinus mucoceles had a bony wall between the membranous mucocele and the nasal cavity, while the wall was membranous in the remaining 18. Stoma closure was noted in four mucoceles at an average of 4.1 weeks after the operation. A statistically significant tendency for stoma closure was observed for mucoceles with bony walls adjacent to the inferior or middle meatus compared with membranous ones.

**Conclusion:** The transnasal approach using a powered instrument has the advantage of decreased postoperative suffering. Based on the results of this study, it appears reasonable to suggest that this is a useful treatment method for a unilocular mucocele adjacent to the medial wall of the antrum. (*Tzu Chi Med J* 2008;20(3):201–205)

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## 1. Introduction

Postoperative formation of maxillary mucoceles is presumed to occur as the result of entrapped sinus mucosa (1). These mucoceles, more commonly reported in Japan, are less prevalent in Taiwan compared to Western countries (2).

The most consistent symptoms of the disease are dull maxillary facial pain, and cheek numbness and swelling (3). Historically, Caldwell-Luc sinusectomy with creation of a nasoantral window through the inferior meatus has been recommended as the optimal treatment (4). However, the development and subsequent widespread introduction of computed tomography (CT) and endoscopy for sinus surgery have provided a viable alternative (5). Endoscopic surgery has been widely used to treat not only chronic paranasal sinusitis but also a variety of sinonasal diseases (6–8). Using this technique, drainage surgery with preservation of the mucosal lining interior to the mucocele is now possible.

In this study, we present a less invasive yet equally effective method for treating postoperative maxillary mucoceles.

## 2. Materials and methods

From January 1988 to December 2006, inclusive, 36 patients (47 sides) diagnosed with a postoperative maxillary sinus mucocele were enrolled in our study. All patients had a history of a previous Caldwell-Luc operation because of chronic paranasal sinusitis. The most consistent signs and symptoms of the disease were swelling and dull intermittent cheek pain. Sinus CT scans were performed in all cases to make the definitive diagnosis. Postoperative complaints such as pain, and cheek swelling and numbness were recorded during patient interviews. Patients with a unilocular cyst, located near the lateral wall of the nasal cavity, were put into the endoscopic marsupialization surgery (EMS) group ( $n=28$ , 36 sides), and patients with multilocular cysts or a unilocular cyst located remote to the lateral nasal wall were put into the revised Caldwell-Luc operation (CL) group ( $n=8$ , 9 sides). The CL group was used as the control. Postoperative complaints in both groups, such as pain, cheek swelling and numbness, were recorded and analyzed by the  $\chi^2$  test.

In the EMS group, the surgical procedures were performed under local or general anesthesia, depending on the patients' preference. All surgical procedures were performed under 30° endoscopic guidance. After infiltration of 2% xylocaine with 1:100,000 epinephrine, medialization of the inferior turbinate was performed. A partial inferior turbinectomy was performed in 5 of 38 nasal cavities to create a better

surgical field. A circumlinear mucosal incision was made over the lateral wall of the middle or inferior meatus using a sickle knife. The incision site was based on the preoperative sinus CT scan and the residual notch in the medial wall of the antrum produced by the previous Caldwell-Luc operation. In 20 mucoceles with a bony wall adjacent to the inferior or middle nasal meatus, a 15° intranasal drill (Medtronic, Jacksonville, FL, USA) was used to remove the bony wall of the maxillary sinus. The stoma was then enlarged as widely as possible to achieve a diameter almost equal to that of the mucocele itself. The cystic wall of the mucocele was incised into the anterior and posterior flaps using the sickle knife. The mucoperiosteal flaps were then extrverted into the nasal cavity. The surgical sites were packed with Vaseline-covered gauze. All patients were discharged 3 days after an uneventful operation. Weekly cleaning of the maxillary sinus operated on was performed endoscopically in the outpatient clinic. At follow-up 1 year after surgery, the stoma was compared with the original opening on the intraoperative videotape recording. We classified these stomas into three categories of patent, reduced, and closed. Transnasal endoscopic revision surgery with insertion of a stoma stent (Hood Laboratories, Pembroke, MA, USA) was performed in mucoceles with stoma closure. The stoma stent was removed 6 months after the revision surgery.

In the CL group, the surgical procedures were performed under local anesthesia. After infiltration of 2% xylocaine with 1:100,000 epinephrine, a mucosal incision was made down to the bone in the gum margin, 3 mm above and parallel to the gingivolabial fold from the posterior edge of the lateral incisor to the second molar tooth. The mucoperiosteal flap was dissected superiorly with a periosteal elevator to expose the anterior wall of the sinus. The mucosa of the maxillary sinus was completely removed through the existing anterior wall window created by the previous Caldwell-Luc operation. A large inferior meatal antrostomy (2 × 1 cm) was made. The maxillary sinus was packed with a Foley balloon, and the surgical site at the inferior nasal meatus was packed with Vaseline-coated gauze for hemostasis. The Foley balloon and the Vaseline-coated gauze were smoothly removed 2 days after the operation. The  $\chi^2$  test was used for statistical analysis of the results.

## 3. Results

There were 22 males and 14 females, with a mean age of  $40.9 \pm 8.74$  years (range, 26–65 years), who had a mean follow-up of  $21.53 \pm 3.35$  months (range, 16–28 months) (Table 1). The mean interval from the first Caldwell-Luc operation to a diagnosis of postoperative maxillary mucocele was  $18.97 \pm 7.73$  years

(Table 2). In the CL group, all patients complained of postoperative cheek swelling and numbness, similar to after the previous Caldwell-Luc surgery. None of the EMS group patients who underwent transnasal marsupialization complained of these problems, but one individual did complain of mild cheek pain postoperatively (Table 3). The antrostoma was established through the inferior and middle meatus in 29 and 9 of the mucocoeles, respectively. There was a bony wall between the mucocoele and nasal cavity in 20 of 38 mucocoeles, while the medial wall of the antrum was membranous in the other 18. The relationship between the principal structural property of the medial wall of the mucocoele and the site of its opening is depicted in Table 4. The bony medial wall was thickened in 7 of 20 mucocoeles.

All 38 mucocoeles studied were located medially in the maxilla. The size of the initial opening was larger than 1 × 1 cm in 89.5% (34/38) of the stomas, and all remained patent. The stoma was obliterated in only 4 of 7 mucocoeles with a thickened bony medial wall. In those 4 mucocoeles, the opening created by the initial endoscopic surgery was smaller than 1 × 1 cm, and the opening of the 4 stomas was reduced 1 year after the removal of the stoma stent placed in the subsequent revision surgery. Of the 38 mucocoeles, the stoma in 18 with a membranous medial wall

adjacent to the inferior or middle meatus was classified as unclosed 1 year after surgery (Fig. 1). In 16 of 20 mucocoeles with a bony medial wall, the opening remained patent 1 year after surgery (Fig. 2). Spearman's correlation test found that stoma size was significantly correlated with the property of the medial wall ( $r=0.46, p<0.01$ ). Specifically, there was a tendency for stoma closure in mucocoeles with a bony wall adjacent to the middle or inferior meatus compared to those with membranous walls (Table 5).

#### 4. Discussion

Postoperative maxillary sinus mucocoeles are a potential long-term sequela of Caldwell-Luc surgery (3). Presumably formed as a result of entrapped sinus mucosa (1), its incidence is much higher in the Japanese population than in Taiwanese or Western populations. As the procedures used for the Caldwell-Luc operation do not especially differ among these countries, it appears reasonable to speculate that the differences may be related to ethnicity (3).

The most prevalent location for a postoperative maxillary sinus mucocoele is reportedly the medioinferior part of the maxilla (9–12). Several authors (10,11) have noted a tendency of the proximity of the mucocoele to the inferior maxillary medial wall and inferior nasal meatus, as well as the presence of a bone defect in the medial wall of the maxillary sinus. The interior of mucocoeles is easily accessed via the inferior nasal meatus using a scalpel (9–11). In our study, however, there were no bone defects in the inferior nasal meatus in 44.7% (17/38) of mucocoeles located in the inferior part of the maxillary sinus. On the contrary, the medial wall was sealed with thickened bone in 18.4% (7/38) of mucocoeles. Removal of the

**Table 1 — Age distribution of 36 patients diagnosed with postoperative maxillary mucocoele**

Age, yr	Patients, n (%)
21–30	3 (8.3)
31–40	19 (52.8)
41–50	8 (22.2)
51–60	5 (13.9)
61–70	1 (2.8)

**Table 2 — Interval between the first Caldwell-Luc operation and the diagnosis of postoperative maxillary mucocoele in 36 patients**

Interval, yr	Patients, n (%)
1–10	2 (5.6)
11–20	10 (27.8)
21–30	19 (52.8)
31–40	4 (11.1)
41–50	1 (2.8)

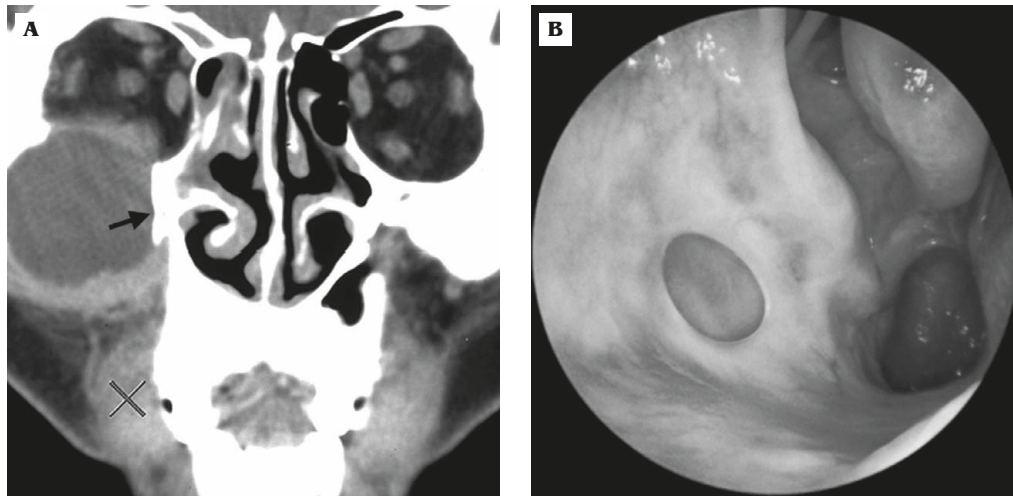
**Table 3 — Comparison of signs/symptoms between the endoscopic marsupialization surgery (EMS) and Caldwell-Luc (CL) groups**

	EMS* (38 sides)	CL* (9 sides)	$\chi^2$ (1)	<i>p</i>
Postoperative cheek swelling	0 (0)	9 (100)	36.00	<0.001
Postoperative pain	1 (3.6)	9 (100)	30.86	<0.001
Postoperative cheek numbness	0 (0)	9 (100)	36.00	<0.001

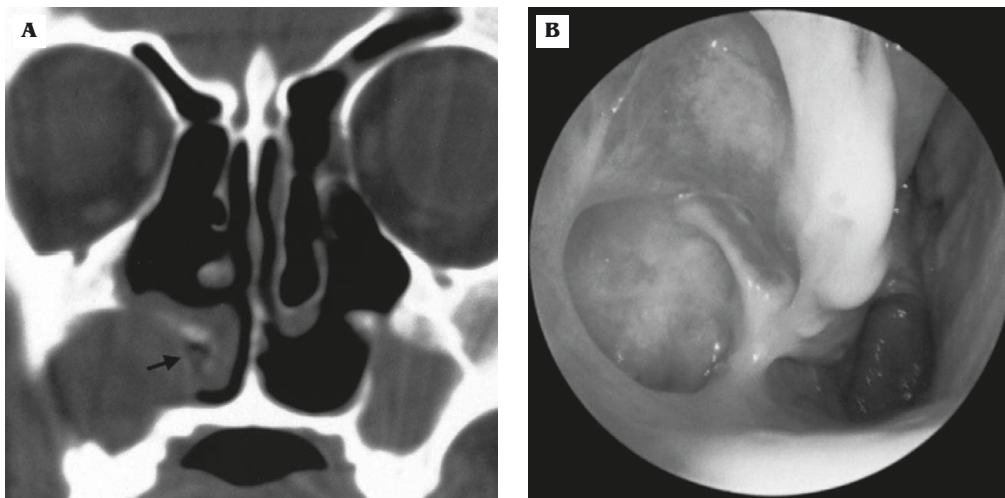
\*Data presented as n (%).

**Table 4 — Relationship between the property of the medial wall and the site of the opening in 38 sides**

Site of opening	Property of medial wall	
	Membranous	Bony
Inferior meatus	12	17
Middle meatus	6	3



**Fig. 1** — Preoperative computed tomography findings and the stoma of a mucocele treated by transnasal endoscopic surgery in a 40-year-old male. (A) Cyst with thickened bony medial wall adjacent to the inferior nasal meatus. (B) Stoma of the mucocele reduced 1 year after surgery.



**Fig. 2** — Preoperative computed tomography findings and the stoma of a mucocele treated by transnasal endoscopic surgery in a 46-year-old female. (A) Cyst with a membranous medial wall adjacent to the inferior nasal meatus. (B) Stoma of the mucocele remained patent 1 year after surgery.

**Table 5** — Stomal size 1 year after the initial operation in the endoscopic marsupialization surgery group (38 sides)

Property of medial wall	Stomal size		
	Patent	Reduced	Closed
Membranous	14	4	0
Bony	7	9	4

bony wall and creation of an antrostoma through the nasal cavity using a scalpel is difficult because of the hardness of the bony wall. Nowadays, powered instruments (6,7,13) are widely used in treating sinonasal

diseases. In our study, a curved microdebrider was passed through the medial or inferior nasal meatus under endoscopic guidance, allowing precise and controlled removal of the bony wall, especially for mucoceles for which the medial wall was thickened and bony. However, it is dangerous to apply the endoscopic marsupialization technique in patients with multilocular cysts or a unilocular cyst located remote to the lateral nasal wall. The revised Caldwell-Luc operation would be a better option for them.

The success of sinus surgery depends on restoring the damaged mucosa to its normal state through a combination of aeration and drainage. Although Hilding (14) demonstrated movement of ink particles

by cilia streaming towards the natural ostium, irrespective of an antrostomy, the situation clearly differs when the cilia are damaged and the mucous is thick and tenacious; however, there is no doubt that these secretions do drain through a patent inferior meatal antrostomy (15). Thus, the decision to create a middle or inferior meatal antrostomy relies on the accessibility of maxillary mucoceles. Keeping the antrostoma patent is the cornerstone of drainage surgery, particularly in patients with a small, contracted antrum. Lund (15) pointed out that although anatomical constraints limit the antrostomy size, ideally, windows of at least 1 × 1 cm should be fashioned to ensure long-term patency. In our study, the size of the initial opening was larger than 1 × 1 cm in 89.5% (34/38) of the stomas, and all remained patent. Only the stomas in 4 of 7 mucoceles with a thickened bony medial wall were obliterated. The openings of the 4 intraoperatively created stomas were smaller than 1 × 1 cm, possibly due to obliteration of the maxillary sinus with various amounts of fibro-osseous tissue after Caldwell-Luc surgery. To resolve the 4 failed cases, we placed a stomal stent to prevent stomal closure during endoscopic revision surgery, and the 4 stomata were only reduced after removal of the stomal stent. Shikani (16) also introduced a middle meatal antrostomy stent to prevent adhesion and maintain stomal patency. So, intraoperative insertion of a stomal stent to prevent stomal closure in mucoceles with a small stoma (1 × 1 cm) appears to be a superior alternative. As to postoperative discomfort, only one patient complained of mild cheek pain after marsupialization surgery, compared with the CL group where all patients experienced cheek swelling and numbness. Thus, we suggest that transnasal endoscopic marsupialization surgery is a useful procedure for treating unilocular postoperative maxillary sinus mucoceles adjacent to the inferior or middle nasal meatus.

The transnasal approach with a powered instrument has the advantages of decreased pain, and cheek swelling and numbness postoperatively compared to Caldwell-Luc surgery. It is suitable for maxillary sinus mucoceles adjacent to the inferior or middle nasal meatus, particularly in cases where the medial wall of the maxillary sinus is bony. Based on our results, it appears reasonable to suggest that in selected cases, this is the optimal treatment method.

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